

wherein the electro-optical head further comprises means for detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk, and

wherein the material comprising the optical disk is further capable of having multiple holographic gratings created at a one of the plural locations,

wherein the electro-optical head comprises means capable of creating multiple holographic gratings at each one of the plural locations within the disk, each holographic grating within each one of the plural locations being created with at a different wavelength.

C/ 3. An optical memory, comprising:

an optical disk comprising a material in which a holographic grating can be created at plural locations within the disk, wherein the holographic grating represents a stored data element;

an electro-optical head capable of creating the holographic grating at any one of the plural locations within the disk via a plane-wave light beam in conjunction with a counterpropagating focused light beam,

wherein the electro-optical head further comprises means for detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk, and

wherein the material comprising the optical disk is further capable of having multiple holographic gratings created at a one of the plural locations,

wherein the electro-optical head comprises means capable of creating holographic gratings at plural sets of the

plural locations within the disk, the holographic gratings within a particular set of the plural locations being created at a same wavelength which is different from the wavelength used to create holographic gratings within other of the plural sets of plural locations.

4. An optical memory, comprising:

an optical disk comprising a material in which a holographic grating can be created at plural locations within the disk, wherein the holographic grating represents a stored data element;

C/ an electro-optical head capable of creating the holographic grating at any one of the plural locations within the disk via a plane-wave light beam in conjunction with a counterpropagating focused light beam,

wherein the electro-optical head further comprises means for detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk, and

wherein the material comprising the optical disk is further capable of having multiple holographic gratings created at a one of the plural locations, wherein the electro-optical head comprises:

(a) means for generating a beam of substantially coherent light, the wavelength of said beam of light being capable of being varied;

(b) collimating means for collimating the beam of light generated by the generating means;

(c) means for producing a first and second collimated beam of light from the collimated beam of light exiting the collimating means;

(d) means for directing the first collimated beam towards the disk;

(e) means for routing the second collimated beam to focusing means for creating a focused beam, the focused beam being directed at a one of the plural locations within the disk whenever a holographic grating is to be created therein during a recording step; and,

(f) means for blocking the second collimated beam from reaching the one of the plural locations during a reading step; and wherein,

cl (g) the detecting means detects reconstruction light beams emanating from a holographic grating created within a one of the plural locations within the disk whenever a beam of light is generated by the generation means and directed at the one of the plural locations during the reading step.

5. The optical memory of Claim 4, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

6. The optical memory of Claim 4, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

(c) masking means for blocking light reflected from holographic gratings created in adjacent ones of the plural location and for allowing light beams reconstructed from a

holographic grating created in the one of the plural location to reach the light detector.

7. The optical memory of Claim 4, wherein the focusing means is a first focusing means for creating a first focused beam, the apparatus further comprising:

second focusing means for focusing the first collimated beam prior to reaching the disk to create a second focused beam directed at the one of the plural locations within the disk.

8. The optical memory of Claim 7, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

(c) masking means for blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

9. The optical memory of Claim 4, further comprising:  
means for fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

10. The optical memory of Claim 4, wherein the generation means comprises:

a tunable laser diode capable of producing light at a plurality of different wavelengths.

11. The optical memory of Claim 4, wherein the generation means comprises:

a plurality of single-wavelength laser diodes each capable of producing light at a different wavelength than the others.

12. The optical memory of Claim 4, wherein:

C1 the focusing means causes the focused beam to come to a focus at a point outside the material in which a holographic grating can be created.

13. The optical memory of Claim 7, wherein:

(a) the second focusing means causes the second focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the first focusing means causes the first focused beam to come to focus at the same point as the second focused beam.

14. An optical memory, comprising:

an optical disk comprising a material in which a holographic grating can be created at plural locations within the disk, wherein the holographic grating represents a stored data element;

an electro-optical head capable of creating the holographic grating at any one of the plural locations within the disk via a plane-wave light beam in conjunction with a counterpropagating focused light beam,

wherein the electro-optical head further comprises means for detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk, and

wherein the material comprising the optical disk is further capable of having multiple holographic gratings created at a one of the plural locations

wherein the electro-optical head comprises:

(a) means for generating a beam of substantially coherent light, the wavelength of said beam of light being capable of being varied;

C (b) first collimating means for collimating the beam of light generated by the generating means to produce a first collimated beam;

(c) focusing means for focusing the first collimated beam to create a first focused beam directed at a one of the plural locations within the disk;

(d) collimating and focusing means for collimating the first focused beam subsequent to exiting the disk to produce a second collimated beam;

(e) reflecting means for reflecting the second collimated beam back toward the collimating and focusing means such that the collimating and focusing means focuses the second collimated beam to create a second focused beam directed at said one of the plural locations within the disk in a direction opposite from the first collimated beam, whenever a holographic grating is to be created within the disk during a recording step; and,

(f) means for blocking the second collimated beam from reaching said one of the plural locations during a reading step; and wherein,

(g) the detecting means detects reconstruction light beams emanating from a holographic grating created within a one of the plural locations within the disk whenever a beam of light is generated by the generation means and directed at the one of the plural locations during the reading step.

15. The optical memory of Claim 14, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

C/ (c) masking means for blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

16. The optical memory of Claim 14, further comprising:  
means for fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

17. The optical memory of Claim 14, wherein the generation means comprises:

a tunable laser diode capable of producing light at a plurality of different wavelengths.

18. The optical memory of Claim 14, wherein the generation means comprises:

a plurality of single-wavelength laser diodes each capable of producing light at a different wavelength than the others.

19. The optical memory of Claim 14, wherein:

(a) the focusing means causes the focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the collimating and focusing means causes the second focused beam to come to focus at the same point as the first focused beam.

C 20. An optical memory, comprising:

an optical disk comprising a material in which a holographic grating can be created at plural locations within the disk, wherein the holographic grating represents a stored data element;

an electro-optical head capable of creating the holographic grating at any one of the plural locations within the disk via a plane-wave light beam in conjunction with a counterpropagating focused light beam,

wherein the electro-optical head further comprises means for detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk, and

wherein the material comprising the optical disk is further capable of having multiple holographic gratings created at a one of the plural locations,

wherein the electro-optical head comprises:



(a) means for generating a beam of substantially coherent light, the wavelength of said beam of light being capable of being varied;

(b) means for producing a first and second beam of light from the beam of light generated by the generating means;

(c) means for routing the first beam of light to first collimating means for creating a first collimated beam;

(d) means for directing the first collimated beam towards the disk;

(e) means for routing the second beam of light to second collimating means for creating a second collimated beam only during a reading step; and,

(f) focusing means for creating a focused beam, the focused beam being directed at a one of the plural locations within the disk, whenever a holographic grating is to be created within the disk during a recording step; and wherein,

(g) the detecting means detects reconstruction light beams emanating from a holographic grating created within a one of the plural locations within the disk whenever a beam of light is generated by the generation means and directed at the one of the plural locations during the reading step.

21. The optical memory of Claim 20, wherein the focused beam is directed at the one of the plural locations in one of  
(i) a direction opposite from the first collimated beam, or  
(ii) in a same direction as the first collimated beam.

22. The optical memory of Claim 20, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

(c) masking means for blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector,

23. The optical memory of Claim 20, wherein the focusing means is a first focusing means for creating a first focused beam, the apparatus further comprising:

21 second focusing means for focusing the first collimated beam prior to reaching the disk to create a second focused beam directed at the one of the plural locations within the disk.

24. The optical memory of Claim 23, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

(c) masking means for blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

25. The optical memory of Claim 20, further comprising:

means for fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

26. The optical memory of Claim 20, wherein the generation means comprises:

a tunable laser diode capable of producing light at a plurality of different wavelengths.

27. The optical memory of Claim 20, wherein the generation means comprises:

C1 a plurality of single-wavelength laser diodes each capable of producing light at a different wavelength than the others.

28. The optical memory of Claim 20, wherein:

the focusing means causes the focused beam to come to a focus at a point outside the material in which a holographic grating can be created.

29. The optical memory of Claim 23, wherein:

(a) the second focusing means causes the second focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the first focusing means causes the first focused beam to come to focus at the same point as the second focused beam.

30. A method for storing data on an optical disk, the disk being comprised of a material in which a holographic grating can

be created at plural locations within the disk wherein the holographic grating represents a stored data element, the method comprising the steps of:

recording data elements by creating a holographic grating at selected ones of the plural locations within the disk; and

reading data elements by detecting one of (i) a presence, or (ii) an absence of a holographic grating at the plural locations within the disk, wherein:

(a) the material comprising the optical disk is further capable of having multiple holographic gratings created within each of the plural locations;

01 (b) the recording step comprises creating multiple data elements at each one of the plural locations by one of (i) creating a holographic grating, or (ii) refraining from creating a holographic grating, each of the holographic gratings created via a beam of light generated by an electro-optical head, said beam of light having a different wavelength for each holographic grating created in a same one of the plural locations; and,

(c) the reading step comprises reading multiple data elements at each one of the plural locations by detecting one of (i) a presence of a holographic grating, or (ii) an absence of the holographic grating, via a beam of light generated by the electro-optical head, said beam of light being sequentially varied in wavelength to correspond to a wavelength of light and sequence of wavelengths employed to record each one of the multiple data elements recorded.

31. The method for storing data of Claim 30, wherein the reading step comprises the step of:

producing a signal indicating a first binary state whenever the presence of the holographic grating is detected and a second binary state whenever the absence of the holographic grating is detected.

32. The method for storing data of Claim 30, wherein each holographic grating has a variable diffraction efficiency and wherein:

(a) the recording step comprises the steps of varying the diffraction efficiency of each holographic grating during the creation thereof; and,

C1 (b) the reading step comprises the steps of producing a signal proportional to the diffraction efficiency of a holographic grating whenever detected, said signal being indicative of a value of the stored data element represented by the detected holographic grating.

33. A method for storing data on an optical disk, the disk being comprised of a material in which a holographic grating can be created at plural locations within the disk wherein the holographic grating represents a stored data element, the method comprising the steps of:

recording data elements by creating a holographic grating at selected ones of the plural locations within the disk; and

reading data elements by detecting one of (i) a presence, or (ii) an absence of a holographic grating at the plural locations within the disk, wherein:

(a) the material comprising the optical disk is further capable of having multiple holographic gratings created within each of the plural locations;

(b) the recording step comprises recording data elements at plural sets of the plural locations within the disk by one of (i) creating a holographic grating, or (ii) refraining from creating said holographic grating, each of said holographic gratings created within a particular set of the plural locations being recorded via a beam of light generated by an electro-optical head having a same wavelength which is different from a wavelength used to create holographic gratings within other of the plural sets of plural locations; and,

C/ (c) the reading step comprises reading data elements at each location within a particular set of the plural locations by detecting one of (i) a presence of a holographic grating, or (ii) an absence of the holographic grating, via a beam of light generated by the electro-optical head having a wavelength corresponding to the wavelength employed to record the data elements.

34. The method for storing data of Claim 33, wherein the reading step comprises the step of:

producing a signal indicating a first binary state whenever the presence of the holographic grating is detected and a second binary state whenever the absence of the holographic grating is detected.

35. The method for storing data of Claim 33, wherein each holographic grating has a variable diffraction efficiency and wherein:

(a) the recording step comprises the step of varying the diffraction efficiency of each holographic grating during the creation thereof; and,

(b) the reading step comprises the step of producing a signal proportional to the diffraction efficiency of a holographic grating whenever detected, said signal being indicative of a value of the stored data element represented by the detected holographic grating.

36. The method for storing data of Claim 30, wherein the step of recording multiple data elements at each one of the plural locations via the beam of light generated by the electro-optical head, comprises:

C1 (a) generating a beam of substantially coherent light at a selected wavelength whenever it is desired to create a holographic grating at a one of the plural locations within the disk, the selected wavelength of said beam of light being capable of being varied;

(b) collimating the beam of light whenever present;

(c) producing a first and second collimated beam from the collimated beam of light;

(d) directing the first collimated beam towards the disk;

(e) routing and focusing the second collimated beam to create a focused beam, the focused beam being directed at the one of the plural locations within the disk;

(f) varying the selected wavelength of the beam of substantially coherent light;

(g) generating a beam of substantially coherent light at a newly selected wavelength whenever it is desired to create another holographic grating at the one of the plural locations within the disk; and,

(h) repeating steps (b) through (g) until a predetermined number of newly selected wavelengths have been employed.

37. The method for storing data of Claim 36, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

38. The method for storing data of Claim 36, wherein the focused beam is a first focused beam, the method further comprising:

C1 focusing the first collimated beam prior to reaching the disk to create a second focused beam directed at the one of the plural locations within the disk.

39. The method for-storing data of Claim 36, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

40. The method for storing data of Claim 36, wherein the step of focusing the second collimated beam to create a focused beam comprises:

causing the second collimated beam to come to a focus at a point outside the material in which a holographic grating can be created.

41. The method for storing data of Claim 38, wherein:



(a) the step of focusing the first collimated beam prior to reaching the disk to create a second focused beam comprises causing the second focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the step of focusing the second collimated beam to create a first focused beam comprises causing the first focused beam to come to focus at the same point as the second focused beam.

c1 42. The method for storing data of Claim 36, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

43. The method for storing data of Claim 36, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

33<sup>2</sup>,  
44. The method for storing data of Claim ~~35~~, wherein the step of recording data elements at the plural sets of the plural location within the disk via the beam of light generated by the electro-optical head, comprises:

(a) recording data elements within a selected set of the plural locations, said recording comprising the steps of,

(a1) placing the optical head adjacent to a one of the plural location in the selected set of plural locations,

(a2) generating a beam of substantially coherent light at a selected wavelength whenever it is desired to create a holographic grating at the one of the plural locations within the disk, the selected wavelength of said beam of light being capable of being varied,

(a3) collimating the beam of light whenever present,,

(a4) producing a first and second collimated beam from the collimated beam of light,

C1 (a5) directing the first collimated beam towards the disk,

(a6) routing and focusing the second collimated beam to create a focused beam, the focused beam being directed at the one of the plural locations within the disk,

(a7) moving the optical head to a position adjacent to a next one of the plural locations in the selected set of plural locations, and,

(a8) repeating steps (a2) through (a7) for each one of the plural locations in the selected set of plural locations;

(b) varying the selected wavelength of the beam of substantially coherent light; and,

(c) repeating steps (a) and (b) until a predetermined number of newly selected wavelengths have been employed.

45. The method for storing data of Claim 44, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

46. The method for storing data of Claim 44, wherein the focused beam is a first focused beam, the method further comprising:

focusing the first collimated beam prior to reaching the disk to create a second focused beam directed at the one of the plural locations within the disk.

47. The method for storing data of Claim 44, further comprising:

C fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

48. The method for storing data of Claim 44, wherein the step of focusing the second collimated beam to create a focused beam comprises:

causing the second collimated beam to come to a focus at a point outside the material in which a holographic grating can be created.

49. The method for storing data of Claim 46, wherein:

(a) the step of focusing the first collimated beam prior to reaching the disk to create a second focused beam comprises causing the second focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the step of focusing the second collimated beam to create a first focused beam comprises causing the first

focused beam to come to focus at the same point as the second focused beam.

50. The method for storing data of Claim 44, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

51. The method for storing data of Claim 44, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

52. The method for storing data of Claim 30, wherein the step of recording data elements at each one of the plural locations via the beam of light generated by the electro-optical head, comprises:

(a) generating a beam of substantially coherent light at a selected wavelength whenever it is desired to create a holographic grating at a one of the plural locations within the disk, the selected wavelength of said beam of light being capable of being varied;

(b) collimating the beam of light generated by the generating means whenever present to produce a first collimated beam;

(c) focusing the first collimated beam to create a first focused beam directed at a one of the plural locations within the disk;

(d) collimating the first focused beam subsequent to exiting the disk to produce a second collimated beam;

(e) reflecting the second collimated beam back toward the disk;

(f) focusing the second collimated beam to create a second focused beam directed at said one of the plural locations within the disk and oppositely from the first focused beam;

(g) varying the selected wavelength of the beam of substantially coherent light;

cl (h) generating a beam of substantially coherent light at a newly selected wavelength whenever it is desired to create another holographic grating at the one of the plural locations within the disk; and,

(i) repeating steps (b) through (h) until a predetermined number of newly selected wavelengths have been employed.

53. The method for storing data of Claim 52, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

54. The method for storing data of Claim 52, wherein:

(a) the step of focusing the first collimated beam to create a first focused beam comprises causing the first focused

beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the step of focusing the second collimated beam to create a second focused beam comprises causing the second focused beam to come to focus at the same point as the first focused beam.

55. The method for storing data of Claim 52, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

c1 causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

56. The method for storing data of Claim 52, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

57. The method for storing data of Claim 33, wherein the step of recording data elements at the plural sets of the plural location within the disk via the beam of light generated by the electro-optical head, comprises:

(a) recording data elements within a selected set of the plural locations, said recording comprising the steps of,

(a1) placing the optical head adjacent to a one of the plural location in the set of plural locations,

(a2) generating a beam of substantially coherent light at a selected wavelength whenever it is desired to create

a holographic grating at the one of the plural locations within the disk, the selected wavelength of said beam of light being capable of being varied,

(a3) collimating the beam of light generated by the generating means whenever present to produce a first collimated beam,

(a4) focusing the first collimated beam to create a first focused beam directed at a one of the plural locations within the disk,

(a5) collimating the first focused beam subsequent to exiting the disk to produce a second collimated beam,

(a6) reflecting the second collimated beam back toward the disk,

(a7) focusing the second collimated beam to create a second focused beam directed at said one of the plural locations within the disk and oppositely from the first focused beam,

(a8) moving the optical head to a position adjacent to a next one of the plural locations in the selected set of plural locations, and,

(a9) repeating steps (a2) through (a8) for each one of the plural locations in the selected set of plural locations;

(b) varying the selected wavelength of the beam of substantially coherent light; and,

(c) repeating steps (a) and (b) until a predetermined number of newly selected wavelengths have been employed.

58. The method for storing data of Claim 57, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

59. The method for storing data of Claim 57, wherein:

(a) the step of focusing the first collimated beam to create a first focused beam comprises causing the first focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

61 (b) the step of focusing the second collimated beam to create a second focused beam comprises causing the second focused beam to come to focus at the same point as the first focused beam.

60. The method for storing data of Claim 57, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

61. The method for storing data of Claim 57, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

62. The method for storing data of Claim 30, wherein the step of recording data elements at each one of the plural



locations via the beam of light generated by the electro-optical head, comprises:

(a) generating a beam of substantially coherent light at a selected wavelength whenever it is desired to create a holographic grating at a one of the plural locations within the disk, the selected wavelength of said beam of light being capable of being varied;

(b) producing a first and second beam of light from the beam of substantially coherent light, whenever present;

(c) routing the first beam of light to first collimating means for creating a first collimated beam;

c) (d) directing the first collimated beam towards the disk;

(e) routing the second beam of light to second collimating means for creating a second collimated beam;

(f) focusing the second collimated beam to create a focused beam, the focused beam being directed at the one of the plural locations within the disk;

(g) varying the selected wavelength of the beam of substantially coherent light;

(h) generating a beam of substantially coherent light at a newly selected wavelength whenever it is desired to create another holographic grating at the one of the plural locations within the disk; and,

(i) repeating steps (b) through (h) until a predetermined number of newly selected wavelengths have been employed.

63. The method for storing data of Claim 62, wherein the focused beam is directed at the one of the plural locations in

one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

64. The method for storing data of Claim 62, wherein the focused beam is a first focused beam, the method further comprising:

focusing the first collimated beam prior to reaching the disk to create a second focused beam directed at a one of the plural locations within the disk.

65. The method for storing data of Claim 62, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

66. The method for storing data of Claim 62, wherein the step of focusing the second collimated beam to create a focused beam comprises:

causing the second collimated beam to come to a focus at a point outside the material in which a holographic grating can be created.

67. The method for storing data of Claim 64, wherein:

(a) the step of focusing the first collimated beam prior to reaching the disk to create a second focused beam comprises causing the second focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the step of focusing the second collimated beam

to create a first focused beam comprises causing the first focused beam to come to focus at the same point as the second focused beam.

68. The method for storing data of Claim 62, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

69. The method for ~~for~~ storing data of Claim 62, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

70. The method for storing data of Claim 33, wherein the step of recording data elements at the plural sets of the plural location within the disk via the beam of light generated by the electro-optical head, comprises:

(a) recording data elements within a selected set of the plural locations, said recording comprising the steps of,

(a1) placing the optical head adjacent to a one of the plural location in the selected set of plural locations,

(a2) generating a beam of substantially coherent light at a selected wavelength whenever it is desired to create a holographic grating at the one of the plural locations within the disk, the selected wavelength of said beam of light being capable of being varied,

(a3) producing a first and second beam of light from the beam of substantially coherent light, whenever present,

(a4) routing the first beam of light to first collimating means for creating a first collimated beam,

(a5) directing the first collimated beam towards the disk;

(a6) routing the second beam of light to second collimating means for creating a second collimated beam,

(a7) focusing the second collimated beam to create a focused beam, the focused beam being directed at the one of the plural locations within the disk,

21 (a8) moving the optical head to a position adjacent to a next one of the plural locations in the selected set of plural locations, and,

(a9) repeating steps (a2) through (a8) for each one of the plural locations in the selected set of plural locations;

(b) varying the selected wavelength of the beam of substantially coherent light; and,

(c) repeating steps (a) and (b) until a predetermined number of newly selected wavelengths have been employed.

71. The method for storing data of Claim 70, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

72. The method for storing data of Claim 70, wherein the focused beam is a first focused beam, the method further comprising:

focusing the first collimated beam prior to reaching the disk to create a second focused beam directed at a one of the plural locations within the disk.

73. The method for storing data of Claim 70, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

cl 74. The method for storing data of Claim 70, wherein the step of focusing the second collimated beam to create a focused beam comprises:

causing the second collimated beam to come to a focus at a point outside the material in which a holographic grating can be created.

75. The method for storing data of Claim 72, wherein:

(a) the step of focusing the first collimated beam prior to reaching the disk to create a second focused beam comprises causing the second focused beam to come to a focus at a point outside the material in which a holographic grating can be created; and,

(b) the step of focusing the second collimated beam to create a first focused beam comprises causing the first focused beam to come to focus at the same point as the second focused beam.

76. The method for storing data of Claim 70, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

77. The method for storing data of Claim 70, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

78. The method for storing data of Claim 30, wherein the step of reading multiple data elements at each one of the plural locations via the beam of light generated by the electro-optical head, comprises:

(a) generating a beam of substantially coherent light at a selected wavelength, the selected wavelength of said beam of light being capable of being varied;

(b) collimating the beam of light;

(c) directing the collimated beam towards the disk;

(d) detecting a reconstruction light beam emanating from a holographic grating created within a one of the plural locations within the disk;

(e) varying the selected wavelength of the beam of substantially coherent light such that a newly selected wavelength corresponds to a next one of a wavelength of light in a sequence of wavelengths employed to record each one of the multiple data elements recorded;

(f) generating a beam of substantially coherent light at the newly selected wavelength; and,

(g) repeating steps (b) through (f) until all the wavelengths in the sequence of wavelengths employed to record the multiple data elements has been selected.

79. The method for storing data of Claim 78, wherein the step of detecting the reconstruction light beam comprises:

(a) directing light from the disk towards a light detector; and,

c) (c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

80. The method for storing data of Claim 78, further comprising:

focusing the collimated beam prior to reaching the disk to create a focused beam directed at the one of the plural locations within the disk, the focused beam being focused at a same point as the beams used to create the holographic gratings in the disk during a recording step.

81. The method for storing data of Claim 80, wherein the step of detecting reconstruction light beams comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a

holographic grating created in the one of the plural location to reach the light detector.

82. The method for storing data of Claim 78, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode, capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

C1 83. The method for storing data of Claim 78, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

84. The method for storing data of Claim 33, wherein the step of reading a data element at each location in a set of the plural locations within the disk via the beam of light generated by the electro-optical head, comprises:

(a) placing the optical head adjacent to a one of the plural location in a selected set of plural locations,

(b) generating a beam of substantially coherent light at a selected wavelength, the selected wavelength of said beam of light being capable of being varied;

(c) collimating the beam of light;

(d) directing the collimated beam towards the disk;

(e) detecting a reconstruction light beam emanating from a holographic grating created within a one of the plural locations within the disk;



(f) moving the optical head to a position adjacent to a next one of the plural locations in the selected set of plural locations;

(g) repeating steps (b) through (f) for each one of the plural locations in the selected set of plural locations;

(h) varying the selected wavelength of the beam of substantially coherent light such that a newly selected wavelength corresponds to a next one of a wavelength of light in a sequence of of wavelengths employed record each set of the plural locations within the disk;

(i) repeating steps (b) through (i) for each set of plural locations.

C1 85. The method for storing data of Claim 84, wherein the step of detecting the reconstruction light beam comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

86. The method for storing data of Claim 84, further comprising:

focusing the collimated beam prior to reaching the disk to create a focused beam directed at the one of the plural locations within the disk, the focused beam being focused at a same point as the beams used to create the holographic gratings in the disk during a recording step.

87. The method for storing data of Claim 86, wherein the step of detecting the reconstruction light beam comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

88. The method for storing data of Claim 84, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

causing a tunable laser diode capable of producing light at a plurality of different wavelengths, to change the wavelength of light emitted.

89. The method for storing data of Claim 84, wherein the step of varying the selected wavelength of the beam of substantially coherent light comprises:

selecting one of a plurality of single-wavelength laser diodes, each capable of producing light at a wavelength different from the others, to emit said beam of coherent light.

90. An optical memory, comprising:

an optical disk comprising a material in which a holographic grating can be created at plural locations within the disk, wherein the holographic grating represents a stored data element;

an electro-optical head capable of creating the holographic grating at any one of the plural locations within

the disk via a plane-wave light beam in conjunction with a counterpropagating focused light beam,

wherein the electro-optical head further comprises means for detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk, and

wherein the material comprising the optical disk is further capable of having multiple holographic gratings created at a one of the plural locations, wherein the electro-optical head comprises:

(a) means for generating a beam of substantially coherent light;

(b) means for producing a first and second beam of light from the beam of light generated by the generating means;

(c) means for routing the first beam of light to first collimating means for creating a first collimated beam;

(d) means for directing the first collimated beam towards the disk;

(e) means for routing the second beam of light to second collimating means for creating a second collimated beam;

(f) focusing means for creating a focused beam, the focused beam being directed at a one of the plural locations within the disk whenever a holographic grating is to be created therein during a recording step;

(g) means associated with the focusing means for varying the point of focus of the focused beam; and,

(h) means for blocking the second collimated beam from reaching the one of the plural locations during a reading step; and wherein,

(i) the detecting means detects reconstruction light beams emanating from a holographic grating created within one of the plural locations within the disk whenever a beam of light is generated by the generation means and directed at the one of the plural locations during the reading step.

91. The optical memory of Claim 90, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

92. The optical memory of Claim 90, wherein the detecting means comprises:

- (a) a light detector;
- (b) second directing means for directing light from the disk during the reading step towards the light detector;
- (c) second focusing means for focusing the directed light to create a focused directed beam, said focused directed beam comprising reconstructions of focused beams used to create holographic gratings within the disk in an area illuminated by the first collimated beam including the point of focus of each of the focused beams;
- (d) masking means for substantially blocking light beams reconstructed from holographic gratings created within the disk in the area illuminated by the first collimated beam which have a point of focus not coinciding with a portion of the masking means which allows a reconstructed light beam to pass through to the light detector; and,
- (e) means for changing the location of the second focusing means such that a light beam reconstructed from a holographic grating having a desired point of focus and created

at the one of the plural locations has the point of focus coinciding with the portion of the masking means which allows a reconstructed light beam to pass through to the light detector.

93. The optical memory of Claim 90, further comprising:  
means for fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

94. A method for storing data on an optical disk, the disk being comprised of a material in which a holographic grating can be created at plural locations within the disk wherein the holographic grating represents a stored data element, the method comprising the steps of:

recording data elements by creating a holographic grating at selected ones of the plural locations within the disk; and

reading data elements by detecting one of (i) a presence, or (ii) an absence of a holographic grating at the plural locations within the disk, wherein:

(a) the material comprising the optical disk is further capable of having multiple holographic gratings created within each of the plural locations;

(b) the recording step comprises creating multiple data elements at each one of the plural locations by one of (i) creating a holographic grating, or (ii) refraining from creating a holographic grating, each of the holographic gratings created via a beam of light generated by an electro-optical head, said beam of light having a different point of focus for each

holographic grating created in a same one of the plural locations; and,

(c) the reading step comprises reading multiple data elements at each one of the plural locations by detecting one of (i) a presence of a holographic grating, or (ii) an absence of the holographic grating, via a beam of light generated by the electro-optical head, (said beam of light being sequentially varied by point of focus to correspond to a point of focus and a sequence of points of focus employed to record each one of the multiple data elements recorded),

wherein the step of recording data elements at each one of the plural locations via the beam of light generated by the electro-optical head, comprises:

(a) adjusting the position of a means for focusing such that a focused beam created by the focusing means has a selected point of focus,

(b) generating a beam of substantially coherent light whenever it is desired to create a holographic grating at a one of the plural locations within the disk;

(c) producing a first and second beam of light from the beam of substantially coherent light, whenever present;

(d) routing the first beam of light to first collimating means for creating a first collimated beam;

(e) directing the first collimated beam towards the disk;

(f) routing the second beam of light to second collimating means for creating a second collimated beam;

(g) focusing the second collimated beam to create the focused beam, the focused beam being directed at the one of the plural locations within the disk;

(h) varying the selected point of focus of the focused beam; and,

(i) repeating steps (b) through (h) until a predetermined number of newly selected points of focus have been employed.

95. The method for storing data of Claim 94, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

96. The method for storing data of Claim 94, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

97. A method for storing data on an optical disk, the disk being comprised of a material in which a holographic grating can be created at plural locations within the disk wherein the holographic grating represents a stored data element, the method comprising the steps of:

recording data elements by creating a holographic grating at selected ones of the plural locations within the disk; and

reading data elements by detecting one of (i) a presence, or (ii) an absence of a holographic grating at the plural locations within the disk, wherein:

(a) the material comprising the optical disk is further capable of having multiple holographic gratings created within each of the plural locations;

(b) the recording step comprises recording data elements at plural sets of the plural locations within the disk by one of (i) creating a holographic grating, or (ii) refraining from creating said holographic grating, each of said holographic gratings created within a particular set of the plural locations being recorded via a beam of light generated by an electro-optical head having a same point of focus which is different from a point of focus used to create holographic gratings within other of the plural sets of plural locations; and,

c) (c) the reading step comprises reading data elements at each location within a particular set of the plural locations by detecting one of (i) a presence of a holographic grating, or (ii) an absence of the holographic grating, via a beam of light generated by the electro-optical head having a point of focus corresponding to the point of focus employed to record the data elements,

wherein the step of recording data elements at the plural sets of the plural location within the disk via the beam of light generated by the electro-optical head, comprises:

(a) recording data elements within a selected set of the plural locations, said recording comprising the steps of,

(a1) placing the optical head adjacent to a one of the plural locations in the selected set of plural locations,

(a2) adjusting the position of a means for focusing such that a focused beam created by the focusing means has a selected point of focus,



(a3) generating a beam of substantially coherent light whenever it is desired to create a holographic grating at the one of the plural locations within the disk,

(a4) producing a first and second beam of light from the beam of substantially coherent light, whenever present,

(a5) routing the first beam of light to first collimating means for creating a first collimated beam,

(a6) directing the first collimated beam towards the disk,

(a7) routing the second beam of light to second collimating means for creating a second collimated beam,

(a8) focusing the second collimated beam to create the focused beam, said focused beam being directed at the one of the plural locations within the disk,

(a9) moving the optical head to a position adjacent to a next one of the plural locations in the selected set of plural locations, and,

(a10) repeating steps (a3) through (a9) for each one of the plural locations in the selected set of plural locations;

(b) varying the selected point of focus of the focused beam; and,

(c) repeating steps (a) and (b) until a predetermined number of newly selected points of focus have been employed.

98. The method for storing data of Claim 97, wherein the focused beam is directed at the one of the plural locations in one of (i) a direction opposite from the first collimated beam, or (ii) in a same direction as the first collimated beam.

99. The method for storing data of Claim 97, further comprising:

fixing holographic gratings created within the disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

100. A method of transferring data stored on an optical disk to another optical disk, comprising:

C/ (a) placing a blank optical disk adjacent an encoded master optical disk, said blank optical disk being comprised of a material in which holographic gratings can be created at plural locations within the disk but in which no holographic grating have yet been created, said encoded master optical disk being comprised of a material in which holographic gratings can be created at plural locations within the disk and having said holographic gratings created therein at selected ones of the plural location by an interaction of a focused beam and a plane-wave beam, wherein the presence and absence of the holographic gratings at the plural locations within the disk represents stored data; and,

(b) illuminating the blank and master optical disks with a plane-wave beam, wherein the illumination causes reconstruction beams to be produced from the holographic gratings in the master disk, which in combination with the plane-wave beam, create corresponding holographic gratings within the blank disk at locations corresponding to the presence of the holographic gratings of the master disk, and no holographic gratings at locations corresponding to the absence

of the holographic gratings of the master disk, and so transferring the stored data to the blank disk.

101. The method of transferring data according to Claim 100, wherein:

(a) the blank disk is placed over the top of the master disk during said placing step and the plane-wave beam is directed towards an externally facing top surface of the blank disk, said blank disk being transparent to the plane-wave beam; and,

(b) the holographic gratings created in the master disk were created such that the reconstruction beams produced during said illuminating step are directed oppositely from the direction of the plane-wave beam used to illuminate the blank and master disks, thereby causing holographic gratings to be created in the blank disk by the interaction of the counterpropagating reconstruction beams and the plane-wave beam.

102. The method of transferring data according to Claim 100, wherein:

(a) the master disk is placed over the top of the blank disk during said placing step and the plane-wave beam is directed towards an externally facing top surface of the master disk, said master disk being transparent to the plane-wave beam; and,

(b) the holographic gratings created in the master disk were created such that the reconstruction beams produced during said illuminating step are produced in the same direction as the plane-wave beam used to illuminate the blank and master disks, thereby causing holographic gratings to be created in the

blank disk by the interaction of the co-propagating reconstruction beams and the plane-wave beam.

103. The method of transferring data according to Claim 100, wherein:

(a) the holographic gratings created in the master disk have varying diffraction efficiencies thereby producing reconstruction beams of proportionally varying intensities during said illumination step;

9/ (b) the blank disk material is intensity-sensitive such that a holographic grating created in the blank disk during said illuminating step will vary in diffraction efficiency in proportion to the intensity of the reconstruction beam produced from the master disk, thereby resulting in holographic gratings of the blank disk having the same relative diffraction efficiencies as holographic gratings of the master disk.

104. The method of transferring data according to Claim 103, wherein:

(a) the blank disk material is further time sensitive such that a holographic grating created in the blank disk during said illuminating step will vary in diffraction efficiency in proportion to a duration of the application of the plane-wave beam;

(b) the plane-wave beam is applied during said illuminating step for a time sufficient to create holographic gratings within the blank disk having a desired absolute diffraction efficiency.

105. The method of transferring data according to Claim 100, further comprising:

fixing holographic gratings created within the blank disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

106. The method of transferring data according to Claim 100, wherein the wavelength of light used to create a particular group of holographic gratings in the master disk differs from the wavelength of light used to create other groups of holographic gratings in the master disk, the method further comprising:

illuminating the blank and master disks with successive plane-wave beams, each plane-wave beam having a different one of the wavelengths of light employed to create holographic gratings in the master disk.

107. The method of transferring data according to Claim 100, wherein the wavelength of light used to create a particular group of holographic gratings in the master disk differs from the wavelength of light used to create other groups of holographic gratings in the master disk, and wherein:

the plane-wave beam comprises at least one of the wavelengths of light employed to create holographic gratings within the master disk.

108. A method of transferring data to an optical disk, comprising the steps of:

(a) placing a blank optical disk adjacent a mask, said mask having a plurality of light beam producing features which when illuminated produce light beams directed toward the blank disk, said features being located so as to be adjacent

locations within the blank disk where holographic gratings are desired to be created; and,

(b) illuminating the blank disk and mask with a plane-wave beam, thereby causing light beams to be produced from the light beam producing features of the mask, said light beams in combination with the plane-wave beam creating holographic gratings within the blank disk at locations adjacent the features, and no holographic gratings at locations not adjacent the features, wherein the presence and absence of the holographic gratings within the blank disk represents sets of data.

109. The method of transferring data according to Claim 108, further comprising the step of:

fixing holographic gratings created within the blank disk such that light impinging on the disk does not create new holographic gratings and does not affect holographic gratings already existing in the disk.

110. The method of transferring data according to Claim 108, wherein:

(a) the placing step comprises placing the blank disk adjacent a series of successive masks, each successive mask capable of creating a separate set of data within the blank disk; and,

(b) the illuminating step comprises illuminating the blank disk and each successive mask with successive plane-wave beams, each successive plane-wave beam having a different wavelength of light.

111. The method of transferring data according to Claim 108, wherein:

(a) the placing step comprises placing the blank disk adjacent a series of successive masks, each successive mask capable of creating a separate set of data within the blank disk, and a distance separating the blank disk from each successive mask being varied such that the distance is different for each of the masks; and,

(b) the illuminating step comprises illuminating the blank disk and each successive mask with a plane-wave beam.

112. The method of transferring data according to Claim 108, wherein the light beam producing features are reflective and the blank disk is transparent to the plane-wave beam, and wherein:

(a) the placing step comprises placing the blank disk over the top of the mask with a top side of the blank disk down; and,

(b) the illuminating step comprising directing the plane-wave beam towards an externally facing bottom side of the blank disk such that the plane-wave propagates through the blank disk and illuminates the reflective light beam producing features of the mask, thereby producing counterpropagating light beams which in conjunction with the plane-wave beam form holographic gratings in the blank disk.

113. The method of transferring data according to Claim 108, wherein portions of the mask not comprising light beam producing features are at least partially transmissive to the plane-wave beam and the light beam producing features whenever illuminated by the plane-wave beam produce light beams

propagating in the same direction as the plane-wave beam, and wherein:

(c) the placing step comprises placing the blank disk below the mask; and,

(d) the illuminating step comprises directing the plane-wave beam towards an externally facing surface of the mask such that the plane-wave propagates through the mask and into the blank disk and illuminates the light beam producing features, thereby producing co-propagating light beams which in conjunction with the plane-wave beam form holographic gratings in the blank disk.

114. The method of transferring data according to Claim 113, wherein:

the light beam producing features of the mask comprise areas of higher transmissibility than the areas of the mask not having said features.

115. The method of transferring data according to Claim 113, wherein:

the light beam producing features of the mask comprise areas having a different index of refraction than the areas of the mask not having said features.

116. The method of transferring data according to Claim 108, wherein:

(a) each light-beam producing feature of the mask is capable of producing light beams having a predetermined intensity during said illumination step;

(b) the blank disk material is intensity-sensitive such that a holographic grating created in the blank disk during



said illuminating step will vary in diffraction efficiency in proportion to the intensity of the light beam produced from the light beam producing feature of the mask.

117. The method of transferring data according to Claim 116, wherein:

(a) the blank disk material is further time sensitive such that a holographic grating created in the blank disk during said illuminating step will vary in diffraction efficiency in proportion to a duration of the application of the plane-wave beam;

C/ (b) the plane-wave beam is applied during said illuminating step for a time sufficient to create holographic gratings within the blank disk having a desired diffraction efficiency.

118. An apparatus for reading data from an optical disk, comprising:

(a) an optical disk comprising a material in which a holographic grating may exist at plural locations within the disk, wherein the holographic grating represents a stored data element;

(b) an electro-optical head capable of detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk,

wherein the material comprising the optical disk is further capable of having multiple holographic gratings existing at a one of the plural locations, each one of said multiple holographic gratings having been created via a beam of light having a different wavelength.

119. An apparatus for reading data from an optical disk, comprising:

(a) an optical disk comprising a material in which a holographic grating may exist at plural locations within the disk, wherein the holographic grating represents a stored data element;

(b) an electro-optical head capable of detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk,

wherein the material of the disk can have holographic gratings at plural sets of the plural locations within the disk, the holographic gratings within a particular set of the plural locations having been created at a same wavelength which is different from the wavelength used to create holographic gratings within other of the plural sets of plural locations.

120. An apparatus for reading data from an optical disk, comprising:

(a) an optical disk comprising a material in which a holographic grating may exist at plural locations within the disk, wherein the holographic grating represents a stored data element;

(b) an electro-optical head capable of detecting one of (i) a presence, or (ii) an absence of the holographic grating at any one of the plural locations within the disk,

wherein the electro-optical head comprises:

(a) means for generating a beam of substantially coherent light, the wavelength of said beam of light being capable of being varied;

(b) means for routing the beam of light to collimating means for creating a collimating beam;

(c) means for directing the first collimated beam towards the disk; and,

(d) means for detecting reconstruction light beams emanating from a holographic grating created within a one of the plural locations within the disk whenever a beam of light is generated by the generation means and directed at the one of the plural locations.

121. The apparatus of Claim 120, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

(c) masking means for blocking light reflected from holographic gratings created in adjacent ones of the plural location and for allowing light beams reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

122. The apparatus of Claim 120, further comprising: focusing means for focusing the first collimated beam prior to reaching the disk to create a focused beam directed at the one of the plural locations within the disk.

123. The apparatus of Claim 122, wherein the detecting means comprises:

(a) a light detector;

(b) second directing means for directing light from the disk during the reading step towards the light detector; and,

(c) masking means for blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

124. A method for reading data from an optical disk, the disk being comprised of a material in which a holographic grating may exist at plural locations within the disk wherein the holographic grating represents a stored data element, the method comprising the step of:

reading data elements using an electro-optical head by detecting one of (i) a presence, or (ii) an absence of a holographic grating at the plural locations within the disk, wherein:

(a) the material comprising the optical disk is further capable of having multiple holographic gratings within each of the plural locations; and,

(b) the reading step comprises reading multiple data elements at each one of the plural locations by detecting one of (i) a presence of a holographic grating, or (ii) an absence of the holographic grating, via a beam of light generated by the electro-optical head, said beam of light being sequentially varied in wavelength to correspond to a wavelength of light and sequence of wavelengths employed to record each one of the multiple data elements recorded.

125. The method for reading data of Claim 124, wherein the step of reading multiple data elements at each one of the plural locations via the beam of light generated by the electro-optical head, comprises:

(a) generating a beam of substantially coherent light at a selected wavelength, the selected wavelength of said beam of light being capable of being varied;

(b) collimating the beam of light,

(c) directing the collimated beam towards the disk;

(d) detecting a reconstruction light beam emanating from a holographic grating created within a one of the plural locations within the disk;

(e) varying the selected wavelength of the beam of substantially coherent light such that a newly selected wavelength corresponds to a next one of a wavelength of light in a sequence of wavelengths employed to record each one of the multiple data elements recorded;

9 (f) generating a beam of substantially coherent light at the newly selected wavelength; and,

(g) repeating steps (b) through (f) until all the wavelengths in the sequence of wavelengths employed to record the multiple data elements has been selected.

126. The method for reading data of Claim 125, wherein the step of detecting the reconstruction light beam comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

127. The method for reading data of Claim 125, further comprising:

focusing the collimated beam prior to reaching the disk to create a focused beam directed at the one of the plural locations within the disk, the focused beam being focused at a same point as the beams used to create the holographic gratings in the disk during a recording step.

128. The method for reading data of Claim 127, wherein the step of detecting reconstruction light beams comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

129. A method for reading data from an optical disk, the disk being comprised of a material in which a holographic grating may exist at plural locations within the disk wherein the holographic grating represents a stored data element, the method comprising the step of:

reading data elements using an electro-optical head by detecting one of (i) a presence, or (ii) an absence of a holographic grating at the plural locations within the disk, wherein:

(a) the material comprising the optical disk is further capable of having multiple holographic gratings existing within each of the plural locations; and,

(b) the reading step comprises reading data elements at each location within a particular set of the plural locations

by detecting one of (i) a presence of a holographic grating, or (ii) an absence of the holographic grating, via a beam of light generated by the electro-optical head having a wavelength corresponding to the wavelength employed to record the data elements.

130. The method for reading data of Claim 129, wherein the step of reading a data element at each location in a set of the plural locations within the disk via the beam of light generated by the electro-optical head, comprises:

(a) placing the optical head adjacent to a one of the plural location in a selected set of plural locations,

(b) generating a beam of substantially coherent light at a selected wavelength, the selected wavelength of said beam of light being capable of being varied;

(c) collimating the beam of light;

(d) directing the collimated beam towards the disk;

(e) detecting a reconstruction light beam emanating from a holographic grating created within a one of the plural locations within the disk;

(f) moving the optical head to a position adjacent to a next one of the plural locations in the selected set of plural locations;

(g) repeating steps (b) through (f) for each one of the plural locations in the selected set of plural locations;

(h) varying the selected wavelength of the beam of substantially coherent light such that a newly selected wavelength corresponds to a next one of a wavelength of light in a sequence of wavelengths employed to record each set of the plural locations within the disk;

(i) repeating steps (b) through (i) for each set of plural locations.

131. The method for reading data of Claim 130, wherein the step of detecting the reconstruction light beam comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in the one of the plural location to reach the light detector.

132. The method for reading data of Claim 130, further comprising:

focusing the collimated beam prior to reaching the disk to create a focused beam directed at the one of the plural locations within the disk, the focused beam being focused at a same point as the beams used to create the holographic gratings in the disk during a recording step.

133. The method for reading data of Claim 132, herein the step of detecting the reconstruction light beam comprises:

(a) directing light from the disk towards a light detector; and,

(c) blocking light beams reconstructed from holographic gratings created in adjacent ones of the plural location and for allowing a light beam reconstructed from a holographic grating created in one of the plural locations to reach the light detector.--

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